
Directed Dopaminergic Neuron Differentiation from Human Pluripotent Stem Cells.

Journal: J Vis Exp

Publication Year: 2014

Authors: Pengbo Zhang, Ninuo Xia, Renee A Reijo Pera

PubMed link: 25285746

Funding Grants: The Stanford University Center for Human Embryonic Stem Cell Research and Education

Public Summary:

Dopaminergic (DA) neurons in the substantia nigra pars compacta (also known as Ag DA neurons) are the specific cell type that is lost in Parkinson's disease (PD). There is great interest in deriving Ag DA neurons from human pluripotent stem cells (hPSCs) for regenerative cell replacement therapy for PD. During neural development, Ag DA neurons originate from the floor plate (FP) precursors located at the ventral midline of the central nervous system. Here, we optimized the culture conditions for the stepwise differentiation of hPSCs to Ag DA neurons, which mimics embryonic DA neuron development. In our protocol, we first describe the efficient generation of FP precursor cells from hPSCs using a small molecule method, and then convert the FP cells to Ag DA neurons, which could be maintained in vitro for several months. This efficient, repeatable and controllable protocol works well in human embryonic stem cells (hESCs) and human induced pluripotent stem cells (hiPSCs) from normal persons and PD patients, in which one could derive Ag DA neurons to perform in vitro disease modeling and drug screening and in vivo cell transplantation therapy for PD.

Scientific Abstract:

Dopaminergic (DA) neurons in the substantia nigra pars compacta (also known as Ag DA neurons) are the specific cell type that is lost in Parkinson's disease (PD). There is great interest in deriving Ag DA neurons from human pluripotent stem cells (hPSCs) for regenerative cell replacement therapy for PD. During neural development, Ag DA neurons originate from the floor plate (FP) precursors located at the ventral midline of the central nervous system. Here, we optimized the culture conditions for the stepwise differentiation of hPSCs to Ag DA neurons, which mimics embryonic DA neuron development. In our protocol, we first describe the efficient generation of FP precursor cells from hPSCs using a small molecule method, and then convert the FP cells to Ag DA neurons, which could be maintained in vitro for several months. This efficient, repeatable and controllable protocol works well in human embryonic stem cells (hESCs) and human induced pluripotent stem cells (hiPSCs) from normal persons and PD patients, in which one could derive Ag DA neurons to perform in vitro disease modeling and drug screening and in vivo cell transplantation therapy for PD.

Source URL: <http://www.cirm.ca.gov/about-cirm/publications/directed-dopaminergic-neuron-differentiation-human-pluripotent-stem-cells>